

A New or Interesting Species of the Genus *Ramalina* (Ascomycotina: Ramalinaceae) from Korea and Japan

Hiroyuki Kashiwadani¹ and Kwang-Hee Moon²

¹ Department of Botany, National Science Museum,
4–1–1 Amakubo, Tsukuba, Ibaraki Japan 305–0005
E-mail: hkashiwa@kahaku.go.jp

² Natural Science Institute, Sookmyung Women's University, Seoul, Korea
(Present address: Department of Botany, National Science Museum, Tokyo, Japan)
E-mail: moonkh@kahaku.go.jp

Abstract *Ramalina coreana* Kashiw. & K.H.Moon is described from lava in Mt. Kumgang and the Cheju Island in Korea. It is morphologically close to *R. farinacea* (L.) Ach. but differs in having a common holdfast and in producing divaricatic acid. *R. pumila*, a species known only from China, is found in the Cheju Island and also in Japan where it grows on trunks of trees along the coast.

Key words: *Ramalina koreana*, *Ramalina pumila*, lichen, new species, Korea and Mt. twigs and in the Cheju Island, Korea and south-west Japan.

In the course of reviewing *Ramalina* collections in TNS from the Korean Peninsula including Cheju Island, we have found two interesting species of the genus. We give the name *Ramalina coreana* for the first species. The second species, *R. pumila* Mont., is the first report from Korea as well as Japan, where it grows on bark and twigs of trees along the coast.

Material and methods

The present report is basically based on the collections made by us in the Cheju Island in May–June 2001. Additional specimens preserved in TNS are also used for the present report. The secondary products of the specimens examined were detected by thin layer chromatography (TLC) using the amended procedures of Culbertson & Johnson (1982) but only solvent B was employed. To evaluate anatomical variation within the thallus and apothecia, sections were cut by hand with a razor blade. These were mounted in lactophenol-cotton blue solution and the anatomy and spores were examined with standard light microscopic procedures.

Taxonomy

Ramalina coreana Kashiw. & K.H.Moon sp. nov.

Thallus ut in *Ramalina farinacea* sed haptero communibus, sorediis granularibus et acidium divaricatum continentibus differt.

Type collection: Korea. Prov. Kangwong: Mt. Shinsun-bong, Mt. Kumgang. On rocks August 1, 1916, T. Nakai s.n.-holotype in TNS. Chemistry (TLC): divaricatic acid (major), 4'-O-demethyldivaricatic (minor) and usnic acid.

Thallus saxicolous, up to 3 cm high, shrubby, sparingly branched, growing from a common holdfast. Laciniae greenish yellow, solid, surface flat, 0.3–1(–1.5) mm wide; main branches never forming secondary branchlets. Soralia marginal or laminal, ellipsoid; soredia granular, covered by a smooth layer, often with spinules. Pseudocyphellae sparse, ellipsoid, flat. Laciniae 150–300 μ m thick; cortex more or less distinct, 7–10 μ m thick; chondroid tissue continuous or partly dissected by pseudocyphellae, smooth; medulla loose.

Apothecia laminal or submarginal, up to 0.7 mm in diam.; margin entire; disc flat to convex



Fig. 1. Holotype of *Ramalina coreana*. Bar=1 cm

with white margin; thalline exciple entire but rarely with striation by narrow grooves; hymenium $50\text{--}60\text{ }\mu\text{m}$ high; subhymenium $20\text{--}30\text{ }\mu\text{m}$ thick, proper exciple $40\text{--}60\text{ }\mu\text{m}$ thick; ascospores narrowly fusiform, $13\text{--}15 \times 4.8\text{--}5.2\text{ }\mu\text{m}$. Pycnidia with pale ostioles; pycnoconidia bacillar, up to $2.5\text{ }\mu\text{m}$ long.

Chemistry: usnic, divaricatic and 4'-O-demethyldivaricatic acids.

Ramalina coreana (Fig. 1) is distinct in having delimited soralia with granular soredia covered by a smooth outer layer. This type of soredia was first reported by Stevens (1987) from several species such as *R. capitata* (Ach.) Nyl., *R. caespitella* Stev., *R. reducta* Krog & Swinsc., etc. *R. coreana* resembles *R. farinacea*, a species widely distributed in the temperate regions in the world, in morphology of laciniae with soralia. However, it can be distinguished from the latter by the

laciniae with a common holdfast and by the granular soredia covered by a smooth layer (up to $40\text{--}60\text{ }\mu\text{m}$ in diameter, Fig 2A). In *R. farinacea*, the soredia are always farinose without a smooth layer (Fig. 2B). In addition, *R. koreana* produces divaricatic acid rather than depsidones (e.g. protocetraric, salazinic, norstictic acids) found in *R. farinacea*. It might be confused with *R. erumpens* Blanchon *et al.*, a species found in New Zealand and Vanuatu, since they have similar soredia with branchlets. However, the latter species has a narrow holdfast and narrowly fusiform spores and produces depsidones. *R. peruviana* Ach., a species widely distributed in temperate regions in the world, also have laciniae growing from a common holdfast with soredia. However, it can be separated by the narrowly fusiform spores and by the production of homosekikaic and sekikaic acid aggregates.

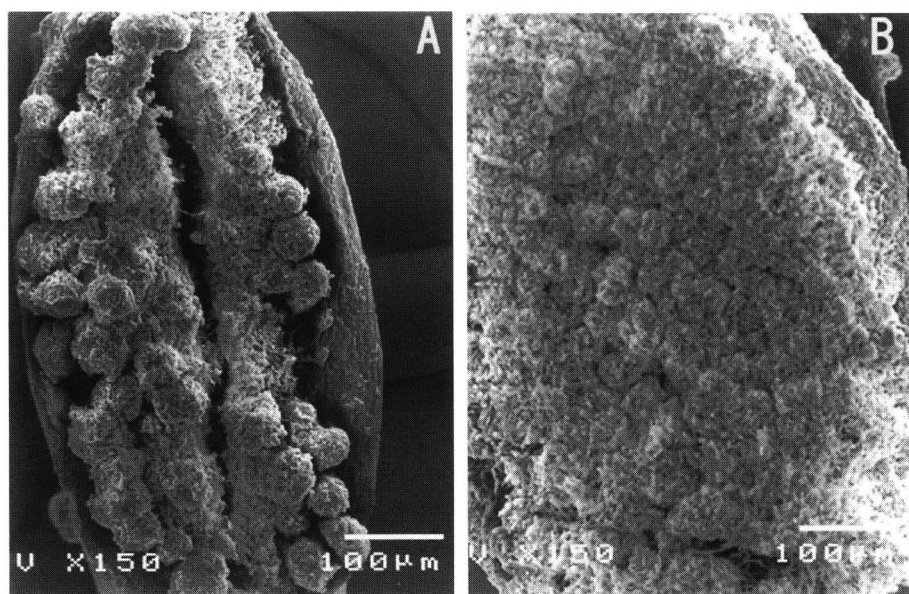


Fig. 2. SEM photographs showing soredia of *R. coreana* and *R. farinacea*. A: granular soredia covered by outer layers—*R. coreana*, holotype. B: farinose soredia without outer layers—*R. farinacea* (Slovenia, Pohorje, H. Kashiwadani 40155, TNS).

R. coreana has been collected so far at two localities in Korea. Although detail was not indicated on the label of the type specimen, the specimens cited below were found on the west facing edge of craters of Hinode Cape where it forms big colonies on rocks.

Specimens examined. Korea. Prov. Cheju: Sonsan-Ilchubong, Sonsan-up, Namcheju-gun, Cheju Island (33°28'N, 126°56'E). On rock, elevation 182 m, May 29, 2001. H. Kashiwadani (no. 43759 & 43761, TNS) & K.H. Moon.

Ramalina pumila Mont.

Ann. Sci. Nat. Bot. ser. 2, 20: 356.1843. Type collection: China, Canton, Gaudichaud s.n. [holotype in PC (not seen); isotype H-NYL-36852!]. TLC: divaricatic and 4'-O-demethyl divaricatic acid.

Thallus corticolous, up to 1.5 cm high, shrubby, sparingly and irregularly branched, growing from a narrow holdfast. Laciniae greenish yellow, fistulose, with small sparse perforations on the lower side, 0.3–1(–1.2) mm wide; main

branches flattened in basal parts, more or less inflated in distal branches ending in attenuate tips, with short cylindrical side branches. Soredia absent. Pseudocyphellae absent. Laciniae 150–300 μ m thick; cortex indistinct; chondroid tissue thin, continuous, smooth; medullary hyphae continuous on the upper cortex, very thin and discontinuous on the lower cortex especially around the perforations. Apothecia laminal or submarginal, up to 1.2 mm in diam.; margin entire; disc flat to convex, without white margin; thalline exciple complete; hymenium 40–45 μ m high; subhymenium 8–10 μ m thick, proper exciple 20–30 μ m thick; ascospores shortly-fusiform, 10–12 $\times$ 3–3.5–4 μ m. Pycnidia not seen.

Chemistry: (Race 1) usnic, divaricatic and 4'-O-demethyldivaricatic acid. (Race 2) usnic, sekikaic and 4'-O-demethylsekikaic acid.

Ramalina pumila (Fig. 3) is characterized by 1) the small thallus less than 1.5 cm high of corticolous habit, 2) the hollow laciniae with a delimited holdfast, 3) the tapering distal branches and the presence of sparse cylindrical branchlets on

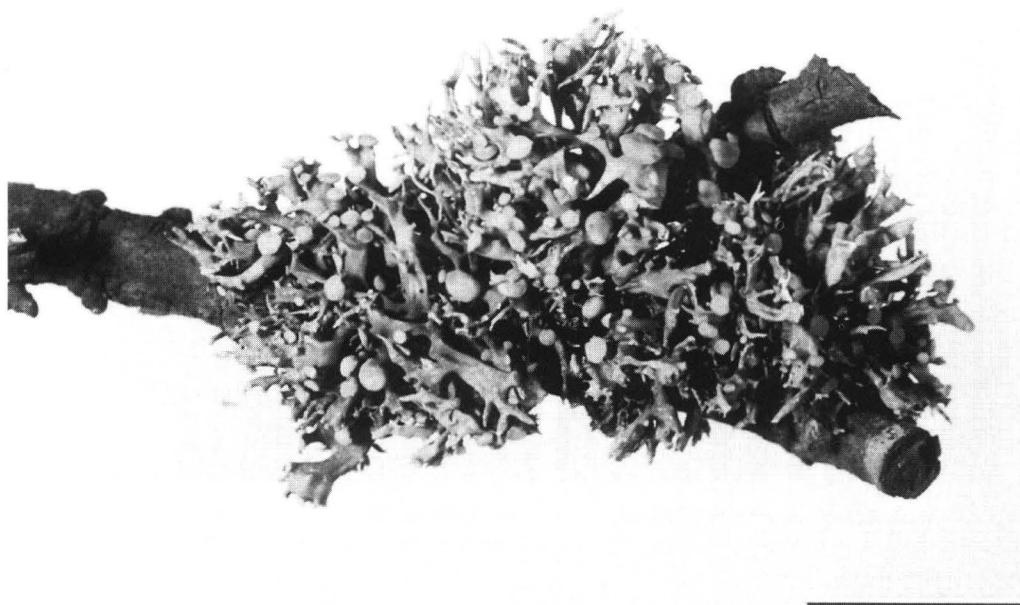


Fig. 3. Specimen of *R. pumila* from the Cheju Island (H. Kashiwadani 43834, TNS) & K. H. Moon. Bar=1 cm

main laciniae, 4) the subterminal apothecia with spurs, 5) the continuous medullary hyphae, 6) the shortly fusiform spores and 7) the presence of divaricatic and sekikaic acids as major chemical substances.

Although this species is rather easily distinguished from the related species by the characters shown above, it shows a variation for spore shape; shortly bursiform spores as in the type and more or less elongated and longly-fusiform spores. However, this type of variation can be often observed in a single apothecium and seems to have no taxonomic value.

Two chemical races, a divaricatic acid-containing race (Race 1 as the type) and a sekikaic acid-containing race (Race 2) are recognized. However, these two races are indistinguishable morphologically, and are treated as a single species, though the sekikaic acid containing race is apparently more common than the divaricatic

acid race.

Ramalina pumila might be confused with *R. dilacerata* (Hoffm.) Hoffm., a species widely distributed in mountain regions in the Northern Hemisphere, in external morphology of plant and in chemical characters. However, it can be distinguished from the latter by the continuous medullary hyphae (Fig. 4A) and by the longly fusiform spores. In *R. dilacerata* the medullary hyphae forms clusters of hyphae and embedded strands of chondroid tissue are characteristically found on the lower surface of the cortex. (Fig. 4B).

Ramalina pumila has been known only from China (Montagne 1843, Hue 1899. However the distribution now extends north to Korea and Japan where it grows on twigs or barks of trees near the coast.

Specimens examined. Race. 1 (the divaricatic acid race). JAPAN. Ryukyu Islands: Kumejima.

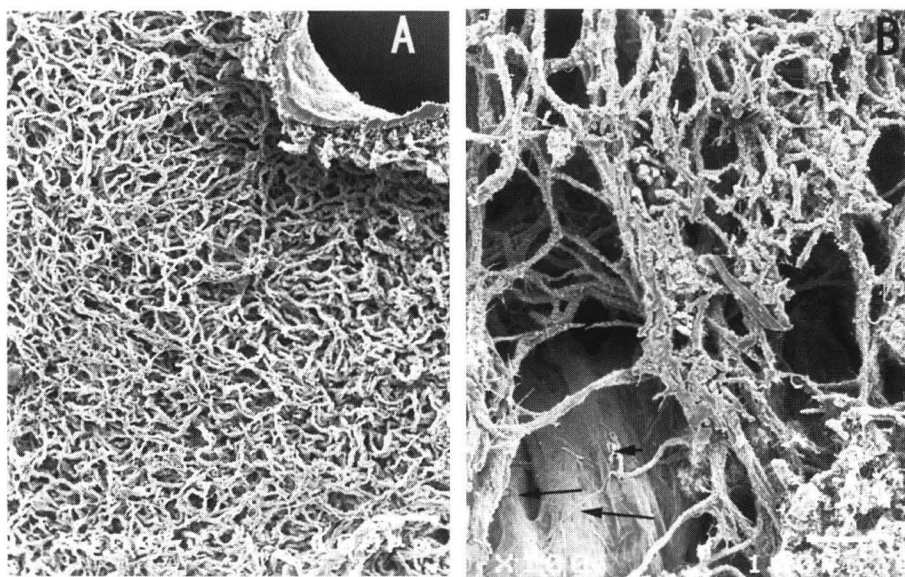


Fig. 4. SEM photographs showing medullary hyphae. A: continuous medullary hyphae of *R. pumila*. B: discontinuous medullary hyphae with cartilaginous tissue (arrows) of *R. dilacerata* (Lapponiae Lulensis, P. J. Hellbom s.n., TNS)

On bark of *Oreodoxa regia*. March 31, 1966 (TNS); Yoron Island, M. Tagawa & K. Iwatsuki 2487 (TNS); Shuri, Okinawa Island, May 1931, S. Asahina 94 (TNS). CHINA. Hong Kong, Wildford 333 (BM). Prov. Fukien, Namputo, Amoy, H. H. Chung F41b, F285 & F416 (FH).

Race 2 (the sekikaic acid race). KOREA. Prov. Cheju: Yongonpo, Namcheju-gun, Cheju Island (33°23'N, 126°53'E). On twigs of *Eurya* sp. along the coast, elevation about 10 m, June 1, 2001, H. Kashiwadani (no. 43834 & 43838) & K. H. Moon. JAPAN. Honshu. Prov. Rikuzen: Mt. Tamon, Matsushima, Shiogama. September 8, 1925, Y. Asahina 93 (TNS); Yuriagehama, March 4, 1965, M. Togashi s.n. (TNS). Prov. Iwaki: Tsurushi-hama, Sohma-gun, July 19, 1958, S. Kurokawa 58099 (TNS). Prov. Shiofusa: Cape Inubo, November 6, 1941, Y. Asahina s.n. (TNS). Prov. Hitachi: Arai, Ohno-mura, Kashima-gun, on twigs of *Pinus thunbergii* along the coast, January 25, 1991, H. Kashiwadani 36456 (TNS). Prov. Kazusa: Ichinomiya, April 30, 1952, Y. Asahina s.n. (TNS); Daito, January 13, 1925, Y. Asahina 93b (TNS). Prov. Awa:

Kiyosumi-dera, Mt. Kiyosumi, January 1, 1958, M. Togashi s.n. (TNS). Prov. Izu: Tsumekizaki Cape, Hamazaki-mura, Kamo-gun, February 19, 1970, K. Takahashi 1571 (TNS). Prov. Ise: Futami, Watarai-gun, February 11, 1938, T. Mago-fuku 25 (TNS). Prov. Owari: Morosaki, Chita-gun, F. Fujikawa s.n. (TNS). Prov. Hoki: Asatsu Seashore, Saihoku-gun, August 1926, Y. Asahina 17 (TNS). Prov. Oki: Fuku-ura, Goka-gun, On twigs of *Trachelospermum asiaticum*, alt. ca 3 m, December 1, 1984, H. Kashiwadani 21028 (TNS).

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